Over-winter Occurrence and Maturation of Gonads in Adult *Psychoglypha subborealis* (Banks) and *Glyphopsyche irrorata* (Fabricius)

(Trichoptera: Limnephilidae)

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Adults of several species of limnephilid caddisflies are collected only from fall to spring and are variously referred to (for example, Leonard and Leonard, 1949; Nimmo, 1971; Anderson, 1976) but essentially they are members of a winter fauna. The actual time of emergence of adults of these species is usually unknown and the functional significance of over-wintering adults (in contrast to winter-emerging adults such as *Dolophilodes distinctus* (Walker)) has not been established.

In this paper I describe observations on the occurrence and gonad maturation of adult *Psychoglypha subborealis* (Banks) and *Glyphopsyche irrorata* (Fabricius) from fall to spring in the vicinity of Juneau, Alaska, and suggest a functional significance for over-wintering of these adult caddisflies.

From 1962 to 1974 I casually collected adult caddisflies in the vicinity of Juneau, Alaska (58°18'N, 134°20'W) (most collections were made around my home). Because of their presence from fall to spring, *P. subborealis* and *G. irrorata* were especially noticed. I have 30 collections of *P. subborealis* (17 males, 22 females) and 20 collections of *G. irrorata* (9 males, 21 females; Table 1). *Psychoglypha subborealis* occurred every month from October through May, and *G. irrorata* occurred every month from October through May except January.

The adaptation to cold indicated by Denning (1970) for *Psychoglypha* in general is confirmed for *P. subborealis* and *G. irrorata* by the minimum temperatures for each month I made a collection (Table 1) and by my subjective observation of no correlation between occurrence and warming periods during the winter season. Adults were collected during very cold weather when all known fresh water was covered by ice and snow. The implication is not that these adult caddisflies had recently emerged but that they had emerged during open-water periods and survived into winter. The adults could have originated from two small permanent streams and several intermittent ponds and streams within 2 km of the collection sites. Nimmo (1971) refers adults of *P. subborealis* and *G. irrorata* to habitats ranging from ponds to rivers but does not mention temporary waters.

Table 1. Summary of minimum air temperatures for each month a collection of *Psychoglypha subborealis* or *Glyphopsyche irrorata* was made, number of collections, and numbers of males and females collected near Juneau, Alaska, 1962-1974.

Month	Minimum air temperature[1] (range, °C)	Number of: Psychoglypha subborealis collections	males	females	Glyphopsyche irrorata collections	males	females
October	-4 to 1.5	3	2	3	5	6	0
November	-16 to -7	4	3	1	1	0	1
December	-21.5 to -6	3	1	2	1	0	1
January	-30 to -19	2	2	0	0	—	—
February	-19 to -15.5	3	4	0	1	1	0
March	-20 to -9	10	5	11	3	2	2
April	-14.5 to -4	4	0	4	6	0	11
May	-4 to -2	1	0	1	3	0	6
Totals		30	17	22	20	9	21

[1]Local Climatological Data, Juneau, Alaska, National Weather Service Forecast Office, Municipal Airport, National Oceanic and Atmospheric Administration Environmental Data Service.

Emergence dates of adults (not collection dates), seasonal deposition of eggs, and life span of *P. subborealis* and *G. irrorata* are not recorded in the literature, but the sequence of maturation of the ovaries implies certain aspects of their life history. Comparison of ovaries from my fall to spring collections indicates that ova mature during the winter and oviposition occurs in early spring in both species. During the fall, ovaries are undeveloped and minute and the abdomen is distended with what appears to be fatty tissue. By midwinter the ova are enlarged but remain within the ovariole; much of the fat has disappeared. In early spring the eggs are fully developed for oviposition and most of the body fat has disappeared.

Deposition of eggs of *P. subborealis* appears to commence in early March since abdomens of two females collected then were only partially filled with eggs (147 and 150), which is about half the average of 302 (range 226 to 353) for six subjects "apparently full" of eggs. No partially spent females of *G. irrorata* were collected. The average number of eggs found in six *G. irrorata* collected from 24 March to 5 May was 360 (range 243 to 472). The female *G. irrorata* with the fewest eggs (243) was collected on 5 May and her abdomen appeared to be full.

Apparently both species emerge as sexually immature adults in the fall; the males and females remain active during the winter months, gradually become sexually mature, and mate and oviposit in the spring. Males have abundant fatty tissue in the fall and it is almost totally absent in the spring; however, progressive development of testes was not apparent from examination of my preserved specimens. I did not find pairs in copula but the absence of males in April and May indicates that mating occurred by March followed soon after by death of males. Although the evidence is circumstantial, it appears that the life span of adults is 5 to 7 months.

In a study of adaptations of caddisflies to life in temporary ponds, Wiggens (1973) reviewed the literature on long-lived adults that emerge in early summer and survive to oviposit in the fall. These species have egg matrices which are adapted to permit survival of drought and freezing. Wiggens' studies involved species adapted to live in ponds which were dry from summer to fall (autumnal ponds) or from summer to following spring (vernal ponds). Over-wintering in a gelatinous matrix resistant to drought and cold as described by Wiggens (1973) would be hazardous in climates where freezing droughts are often interspersed with periods of warming and heavy rains. Warming and flooding of the gelatinous matrix could result in dissolution of the matrix and release of larvae susceptible to freezing and desiccation. Functionally, over-wintering adults with gradually maturing gonads and spring oviposition permits survival of winter drought without requiring specially resistant egg matrices, the dry period in this instance being due to freezing of surface drainage waters rather than absence of precipitation.

Literature Cited

Anderson, N. H. 1976. The distribution and biology of the Oregon Trichoptera. Oreg. Agric. Exp. Stn. Tech. Bull. 134. 152 pp.

Denning, D. G. 1970. The genus *Psychoglypha* (Trichoptera: Limnephilidae). Can. Entomol. 102:15-30.

Leonard, J. W., and F. A. Leonard. 1949. An annotated list of Michigan Trichoptera. Occas. Pap. Mus. Zool. Univ. Mich. No. 522. 35 pp.

Nimmo, A. P. 1971. The adult Rhyacophilidae and Limnephilidae (Trichoptera) of Alberta and eastern British Columbia and their post-glacial origin. Quaest. Entomol. 7:3-234.

Wiggens, G. B. 1973. A contribution to the biology of caddisflies (Trichoptera) in temporary pools. Life Sci. Contr., R. Ont. Mus. No. 88. 28 pp.